SYSTEM AND METHOD FOR PLAYING TONES AND ANNOUNCEMENTS IN MULTIMEDIA COMMUNICATIONS NETWORKS

BACKGROUND

[0001] The present invention relates generally to the art of telecommunications, and, more particularly, to a method and system for determining which element in a multimedia communications network will play a particular tone or announcement during a communications session.

[0002] Wireless communications networks allow mobile devices to communicate with each other and other networks, such as the Internet and the public switched telephone network. First and second generation wireless telephone systems are generally constrained in the amount of bandwidth available for communication. This limits capacity and also the types of services that can be provided. Third generation (3G) wireless systems, which are being developed through the 3rd Generation Partnership Project (3GPP), hold the promise of greater bandwidth, thereby increasing capacity and allowing for enhanced services, such as multimedia services. 3GPP is the new worldwide standard for the creation, delivery, and playback of multimedia over new, high-speed wireless networks. 3GPP enables the free sharing of multimedia files between a variety of devices, including cell phones, personal digital assistants (PDAs), and notebook and desktop computers. 3GPP devices include, in addition to a voice communication interface, capability for communication of data and display of data, including video.

[0003] 3G networks include several network components that are adapted to play tones and announcements, such as call failure, call setup, special services tones and announcements. In 3G systems, both the media gateways (MGW) and the media resource function processors (MRFP) have the capability of playing tones and announcements. However, the 3G standards as defined in UMTS (universal mobile telecommunications system) Release 5, the MRFP plays tones and announcements, on

instructions from the CSCF via the multimedia resource function controller (MRFC). In addition, there are fixed rules to route announcements and tones. However, there may be situations when the MRFP cannot apply the treatment (*e.g.,* tones and announcements) to a call, as required.

[0004] Thus, there is a need for a system and method that provides both the MGW and the MRFP with the flexibility to play both announcements and tones. Furthermore, instead of following fixed rules on which component provides what tone or announcement in every call scenario, it would be desirable to allow the CSCF (call session control function) to determine where to play tones and announcements.

SUMMARY OF THE INVENTION

[0005] In accordance with one aspect of the present invention, a method of assigning responsibility for playing tones and announcements to a network element in a multimedia communications network is provided. The method includes receiving a call from a caller to a subscriber at a first network element, as part of the call a tone or an announcement needs to be played to the subscriber; determining whether a second network element is able to play the tone or announcement; playing the tone or announcement through the second network element, if the second network element is able to play the tone or announcement; attempting to locate a third network element that is able to play the tone or announcement, if the second network element is not able to meet the request; and playing the tone or announcement through the third network element, if the third network element is located.

[0006] In accordance with another aspect of the present invention, a system for assigning responsibility for playing tones and announcements to a network element in a multimedia telecommunications network is provided. The system includes a first network element for receiving a call from a caller to a subscriber, as part of the call a

tone or an announcement needs to be played to the subscriber; determining means for determining whether a second network element is able to play the tone or announcement; means for playing the tone or announcement through the second network element, if the second network element is able to play the tone or announcement; attempting means for attempting to locate a third network element that is able to play the tone or announcement, if the second network element is not able to play the tone or announcement; and means for playing the tone or announcement through the third network element, if the third network element is located.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the invention.

[0008] FIG. **1** is a block diagram showing a known multimedia communication environment suitable for practicing aspects of the present invention.

[0009] FIG. **2** is a block diagram showing a Call Session Control Function in accordance with an aspect of the present invention.

[0010] FIG. **3** is a flow chart illustrating a tone and announcement network component selection process in accordance with an aspect of the present invention.

[0011] FIG. **4** is a flow chart illustrating an MRFP lookup process in accordance with an aspect of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] It is to be understood that the specific methods and systems illustrated in the attached drawings and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Therefore,

specific examples and characteristics related to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0013] For simplicity and ease of reference, the acronyms listed below shall be used in the specification to refer to structural and/or functional network elements, relevant telecommunications standards, protocols and/or services, terminology, etc., as they are commonly known in the telecommunications art, except to the extent they have been modified in accordance with aspects of the present invention.

[0014] 3G – 3rd Generation

[0015] 3GPP – 3rd Generation Partnership Project

[0016] 3GPP2 – 3rd Generation Partnership Project 2

[0017] AH – Address Handling

[0018] AS – Application Server

[0019] ATM – Asynchronous Transfer Mode

[0020] BGCF – Border Gateway Control Function

[0021] CCF – Call Control Function

[0022] CDMA – Code Division Multiple Access

[0023] CSCF – Call Session Control Function

[0024] DSP – Digital Signal Processing

[0025] HLR – Home Location Register

[0026] HSS – Home Subscriber Server

[0027] ICGW – Incoming Call Gateway

[0028] IMS – IP Multimedia Subsystem

[0029] IP – Internet Protocol

[0030] MGCF – Media Gateway Control Function

[0031] MGW – Media Gateway

[0032] MRFC – Multimedia Resource Function Controller

[0033] MRFP – Multimedia Resource Function Processor

[0034] PDN – Public Data Network

[0035] PDS – Packet Data Subsystem

[0036] PLMN – Public Land Mobile Network

[0037] PSDN – Packet Switched Data Network

[0038] PSTN – Public Switched Telephone Network

[0039] RAN – Radio Access Network

[0040] SIP – Session Initiation Protocol

[0041] SPD – Serving Profile Database

[0042] TAG – Trunk Access Gateway

[0043] TDM – Time Division Multiplex

[0044] UMTS – Universal Mobile Telecommunications System

[0045] WAG – Wireless Access Gateway

[0046] WLAN – Wireless Local Access Network

[0047] FIG. **1** is a block diagram of a known multimedia communications network **10**, suitable for implementing aspects of the present invention. The multimedia communications network **10** provides users with a variety of options for communication. Users are able to transmit and receive multimedia communications, including audio, voice, video, and all types of data. The multimedia communications network **10** generally provides access to data networks, such as the Internet, and public telephone networks, including wireless networks. It is to be understood, however, that other such networks may be suitable for implementing aspects of the present invention.

[0048] The multimedia communications network **10** preferably includes an IP multimedia subsystem (IMS) **20**. The IMS **20** relates to a technology standardized by the 3rd Generation Partnership Project, also known as 3GPP, and this system is also

defined by 3GPP2 (3rd Generation Partnership Project 2). The IMS **20** is used to join mobile communication with IP technologies by adding the ability to deliver integrated voice and data services over the IP-based packet switched data network (PSDN). IMS services are based on the Session Initiation Protocol (SIP), which is the signaling protocol standard for next-generation 3GPP mobile wireless networks. The IMS **20** includes a number of system elements, such as a call session control function (CSCF) **22**, media gateways (MGW) **24**, a media gateway control function (MGCF) **26**, a border gateway control function (BGCF) **28**, a multimedia resource function processor (MRFP) **30**, a multimedia resource function controller (MRFC) **32,** a home subscriber system (HSS) **34** and any number of application servers **36**. As is known in the art, the IMS **20** manages call sessions and provides and administers packet switching for multimedia communications within the network **10**.

[0049] A first communication device **40** is shown in FIG. **1**. The first communication device **40** may be a wireless device that includes a user interface and an interface for coupling to a radio access network (RAN) **42**. The user interface of the communication device **40** is typically referred to as terminal equipment and generally includes an audio interface, such as a microphone and speakers, a visual interface, such as a display, and a user input interface, such as a keyboard or touch pad. The interface for coupling to the RAN **42** is typically referred to as a mobile terminal and generally includes an over-the-air interface for transmitting and receiving data. The over-the-air interface of the communication device **40** is used to communicate with base stations in the RAN **42**. Preferably, the communication device **40** and the base stations in the RAN **42** communicate over-the-air using a packet-based protocol. A packet data subsystem (PDS) **44** couples the RAN **42** with the IMS **20** and the public data network (PDN) **52** in the usual manner.

[0050] A second communication device **50** is shown as a laptop or notebook computer operatively connected to the IMS **20** via the PDN **52**. The communication device **50** optionally employs a wireless local area network (WLAN) or wireline network, in the usual manner, to operatively connect to the PDN **52**. A third communication device **60** is shown as an ordinary telephone equipped to handle only voice communications. The communication device **60** is operatively connected to the IMS **20** via the public switched telephone network/public land mobile network (PSTN/PLMN) **62**.

[0051] Only three communication devices (**40, 50,** and **60)** are shown in FIG. **1** for the purpose of simplifying the diagram. However, it is to be appreciated that any number of such terminals are typically situated in the multimedia communications network **10**. Additionally, while each is depicted as a specific type of communication device, other like terminals may also be incorporated.

[0052] With continuing reference to FIG. **1**, the bearer paths that carry (or relay) the communication traffic and/or user information for transmission from one terminal to another, which are known in the art, are shown as solid lines. Control paths carry associated signaling and/or control commands (or messages) to and between appropriate network elements for the purpose of managing and routing call sessions. The control paths are shown as dashed lines in FIG. **1**. Suitably, SIP and other known protocols are used on the control and bearer paths, respectively. For example, the known H.248 protocol is suitably employed for media gateway controls. The CSCF **22**, the BGCF **28**, the MGCF **26**, the MRFC **32** and the AS **36** comprise the call control and signaling functionality for the IMS **20**, while the bearer paths interface with the MRFP **30** and the MGW **24** to provide and support interconnectivity to external networks and/or subsystems, such as the PDS **44**, the PDN **52** and the PSTN/PLMN **62**.

[0053] The CSCF **22** supports and controls multimedia sessions. The CSCF **22** invites elements such as the MGCF **26** and the MRFC **32** to call sessions to control the

establishment and maintenance of bearer paths for call sessions by adding, modifying or deleting appropriate bearer paths for respective call sessions. The CSCF **22** is the signaling entity for call session control. It manages sessions by using SIP and/or other appropriate call/session establishment protocols, and it provides features and services and coordinates with other network elements for session control, service control and resource allocation.

[0054] The CSCF **22** may provide the following functionalities: incoming call gateway (ICGW), call control function (CCF), serving profile database (SPD), and address handling (AH). By functioning as an ICGW, the CSCF **22** acts as a call session entry point and routes incoming calls. The CCF generally refers to call setup/termination and state/event management. The CSCF **22** interacts with the MGCF **26** for calls to/from the PSTN/PLMN **62** and with the BGCF **28** for calls to the PSTN/PLMN **62** to determine the appropriate MGCF **26** to use. It also controls the MRFP **30** via the MRFC **32**, which interprets information or signals coming from the CSCF **22** and controls the MFRP **30**, in order to support conferencing and other multi-party services. SIP level registrations from subscribers are processed with the call control function. The call control function may also provide service trigger mechanisms to the AS **36** to invoke services provided thereby, either locally, at the AS **36**, or elsewhere. It also reports call events for billing, auditing, intercept or other purposes, and may query the address handling function to check whether a requested communication is allowed given the current subscription. The serving profiling database function refers to the interaction of the CSCF **22** with the HSS **34** to receive and cache user profile information. The address handling function refers to address analysis, translation, modification (when appropriate) and mapping.

[0055] The MGW **24** acts as a bearer path interface between the IMS **20** and externals networks and/or subsystems, and provides translation resources and resources for modifying the bearer stream (*e.g.*, encoding, transcoding, compression,

packetization, depacketization, etc.). The bearer path elements include the MGCF **26**, the MRFC **32**, and the BGCF **28**. These elements provide the flexibility to add, modify or delete bearers used by the users' services. More particularly, the MGW **24** interacts with the MGCF **26**, which interprets signaling coming from the CSCF **22** and controls the MGW **24** to achieve resource allocation, bearer path control, and payload processing. There may be two types of media gateways used: (1) trunk access gateways (TAG), which have only TDM (time division multiplex) and IP resources, and (2) wireless access gateways (WAG), which have only ATM (Asynchronous Transfer Mode) resources. Either type is capable of playing tones and announcements.

[0056] The MGCF **26** communicates with the CSCF **22** in order to control the call state for media channels on one or more MGWs and performs conversions between Legacy and 3rd Generation (3G) Universal Mobile Telecommunications System (UMTS)/Code Division Multiple Access (CDMA) network call control protocols. Similarly, the MRFC **32** controls the media stream resources in the MRFP **30,** which also acts as a bearer path interface between the IMS **20** and external networks and/or subsystems, while being able to provide for conferencing or multiple party communications or other more advanced media services (relative to the MGW **24**), including tones and announcements. The BGCF **28** selects the proper MGCF **26**.

[0057] The MGW **24** and the MRFP **30** include various types of resources, such as: (1) DSP (digital signal processing) resources, which provide conversion from one payload type to another and are responsible for providing tones and announcements, echo cancellation, and silence suppression; (2) IP resources, which are essentially IP terminations within the MGW **24** and MRFP **30** function and are referred to generally as ephemeral terminations; (3) ATM resources, which are essentially ATM terminations within the MGW **24** function and are referred to generally as ephemeral terminations;

and (4) TDM resources, which are essentially TDM terminations within the MGW **24** function and are referred to generally as physical terminations.

[0058] The HSS **34** is coupled to the CSCF **22** via a data link. The HSS **34** includes subscriber profile information, including information traditionally associated with a home location register (HLR) for a mobile subscriber. Suitably, the HSS **34** stores information such as user identification, user security information, including network access control information for authentication and authorization, user location information for user registration and locating, and user profiles, including identification of the services subscribed to and other service specific information.

[0059] The AS **36** are preferably coupled to the IMS **20** for use in interaction with the communication devices **40, 50, 60**. In particular, the CSCF **22** is coupled to the AS **36** via a data link. Also, the HSS **34** is preferably coupled to the AS **36**. A myriad of services and applications may reside in or be coupled to the AS **36**.

[0060] In the preferred embodiment, the CSCF **22**, the MGCF **26**, the MGW **24**, the HSS **34**, and the AS **36** are processor-based apparatus with data link interfaces for coupling together as described above and shown in FIG. **1**. These apparatus include one or more processors that execute programs to implement the functionality described herein and generally associated with 3GPP/3GPP2 wireless systems. The flexibility of these processor-based systems permits ready integration into these systems of a network element selection method and system in accordance with the present invention.

[0061] As noted above, both the MGW **24** and the MRFP **30** have the flexibility to play announcements and tones. Preferably, the CSCF **22** will determine which element in the network **10** will play a requested tone or announcement during a call session according to an algorithm, which will be explained in greater detail later. Such a

determination made by the CSCF **22** will preferably take into account any or all of the following factors:

a) the available IP/TDM/ATM resources at each of the MGWs **24** and MRFPs **30**;

b) the current congestion (or load) level of each of the MGWs **24** and the MRFPs **30**;

c) the pool of DSP resources available at each of the MGWs **24** and MRFPs **30**; and

d) the proximity of each of the MRFPs **30** to the subscriber's location within the network **10.**

Of course, it is to be understood that this is not an exhaustive list and that the CSCF **22** may consider other factors as well.

[0062] Further, as illustrated in FIG. **2,** the CSCF **22** would preferably include at least one media resource monitoring module **70**, which would constantly receive and store in a database (not shown) media resource data (*i.e.*, load levels) from the MGWs **24** and the MRFPs **30** within the network **10**.

[0063] FIGS. **3** and **4** are flow charts illustrating a preferred method **100** of determining which element in the network **10** (MGW or MRFP) will play a tone or announcement during a communication session. Preferably, the method **100** is implemented through software in the CSCF **22**. However, it is to be understood that the method **100** may be implemented through software distributed throughout the network **10**.

[0064] Initially, in step **102**, a call for a subscriber using communication device **40** is received at the CSCF **22** from a caller using the communication device **60**. Next, a request for IP/ATM/TDM resources (or terminations) is recognized by the CSCF **22** (step **104**). The nature of the resources/terminations requested is related to the type of call involved – i.e., whether it is an IP, an ATM or a TDM-based call. This call may

include a tone or announcement that is to be played to the subscriber. A determination is then made by the CSCF **22**, and preferably by the media resource monitoring module **70**, as to whether the MGW **24** that is nearest the caller (also known as the originating MGW **24**) has sufficient DSP resources for the request (step **106**), *i.e.,* whether the originating MGW **24** can play the requested tone or announcement. It is to be understood, however, that other MGWs **24** in the network **10** may be considered by the CSCF **22**, if necessary. If not, then an MRFP lookup is implemented, as illustrated in FIG. **4** (step **108**) and which will be explained later. However, if there are sufficient DSP resources, a further determination is made as to whether the originating MGW **24** is busy or congested, based upon provisioned values (step **110**). If so, an MRFP lookup is implemented (step **108**). Otherwise, the call may require the tone or announcement to be played through the originating MGW **24** (step **112**).

[0065] With reference to FIG. **4**, the MRFP lookup **108** is described below. Initially, all of the nearest MRFPs **30** for the originating MGW **24** are sought (step **114**). If no suitable MRFPs **30** are found, then the default treatment for the request is made according to the provisions (step **116**). This default treatment will be based on a fixed set of operator-defined (provisioned) treatments. Typically, the default treatment of tones and announcements in this situation is to release the call with the proper cause value, as known to those skilled in the art. However, additional treatments may be provisioned by the operator depending upon the system involved.

[0066] If at least one suitable MRFP **30** is found, however, then a further determination is made by the CSCF **22** as to whether the nearest MRFP **30** is ready to handle the request (step **118**). If so, the treatment of the tone/announcement request is made through the nearest MRFP **30** (step **120**). Otherwise, the nearest MRFPs **30** that may be able to handle the request are sought (step **122**). If none are found, then the default treatment is to release the call with the proper cause value (step **116**).

However, if suitable MRFPs **30** are found, then the treatment is made from the appropriate MRFP **30** based upon their respective congestion levels (step **124**).

[0067] To summarize, if the originating MGW is running out of resources (or is congested) when required to play a tone or announcement, the CSCF is able to provide another source for the tone or announcement. This process is implemented through software on the CSCF that makes a decision based upon the constant monitoring of the various resources in the MGWs and the MRFPs of the network. This process greatly increases the probability of being able to play tones and announcements for subscribers under any circumstances, thus providing more stable communication services for all subscribers. Further, it enables more efficient utilization of DSP resources within the network, thereby reducing the cost of additional DSP resources required during peak hours, while distributing the tone/announcement load among the different components in the network.

[0068] The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.